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ADB Working Paper Series on Regional Economic Integration

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No. 35 | October 2009

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October 2009
Publication Stock No.

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Abstract

A general equilibrium framework is used in this paper to study the regional economic effects of infrastructure improvements designed to reduce the costs of cross-border inter-regional trade. The analysis focuses on the economic benefits from the Second Mekong International Bridge between Mukdahan Province in Thailand and Savannakhet Province in the Lao People's Democratic Republic. The results suggest that in the short-run, the kind of transport cost reductions that are consistent with improvement of inter-regional transport facilities will produce a modest increase in inter-regional trade volumes in both directions and a small increase in real consumption in both regions. Over a longer period of time, the economic benefits to both regions are very much larger, as investors respond to the changed structure of incentives with new capital investments, and as workers move to regions of greater return to their labor. The results do not confirm the common presumption that the benefits from cross-border infrastructure projects occur only, or overwhelmingly, in the richer region.

Keywords: Cross-border infrastructure, general equilibrium, Thailand, Lao PDR

JEL Classification: D58, I32, R40

1. Introduction

Estimating the potential benefits of large-scale public investment projects often poses a practical problem to decision makers; if the benefits of such projects are incorrectly estimated, costly mistakes are likely to be made. This paper attempts to address this problem by using general equilibrium modeling to estimate the benefits of infrastructure investments. More specifically, it applies a large, two-region applied general equilibrium model to estimate the economic impacts of the Second Mekong International Bridge between Mukdahan Province in Thailand and Savannakhet Province in the Lao People's Democratic Republic (Lao PDR).

Two aspects of the bridge's impact are important. First, it generates economic benefits to two relatively backward regions that have traditionally traded more extensively with the rest of the world than with each other. Despite being geographically close to one another, Mukdahan and Savannakhet are separated by the Mekong River, which is a very significant physical barrier. The bridge significantly reduces the economic importance of this barrier, enabling the two provinces to become more closely integrated with one another. Second, and more broadly, the bridge facilitates the development of a major road transport network, linking the People's Republic of China (PRC), Vietnam, Lao PDR, Thailand, and (possibly in the future) Myanmar. There will consequently be benefits to all of these countries, and not just to Mukdahan and Savannakhet or Thailand and Lao PDR.

In this study, we focus on the first of these effects—the benefits accruing to the two provinces directly affected by the bridge. Thus, the analysis only accounts for part of the economic benefits of the bridge. This component of the overall impact has been the subject of much controversy. As with other infrastructure developments, there is a presumption that the bridge will mostly benefit other areas, rather than the local economy. This paper explores whether this presumption is valid.

The analysis draws upon an inter-regional input–output table for Mukdahan and Savannakhet provinces, recently constructed by researchers at the Asian Development Bank (ADB) (Sim et al. 2007). This inter-regional input–output table is used to construct a two-region general equilibrium model linking the two provinces. The recognition of transport costs between the two regions is a feature of the general equilibrium structure. Cross-border infrastructure development is then modeled as a reduction in these inter-regional transport costs.

The Sim et al. input–output structure is modified to allow for the explicit existence of transport margins, both within and between the two provinces. This modified structure is then used to construct a general equilibrium model describing a two-region economy where each region trades with the rest of the world as well as with each other, with each of these two forms of trade facing transport cost barriers. The magnitude of reductions in inter-regional transport costs as a result of the bridge and its associated road connections is estimated using the Sim et al. data and other related studies. These transport cost reductions are combined with the inter-regional general equilibrium model to estimate their economic effects. The benefits are measured as effects on real consumption in each region; the estimated impacts on other economic variables,

including upon the volume of inter-provincial trade, are also of interest and are likewise presented.

2. Mukdahan, Savannakhet, and the East–West Economic Corridor

The Second Mekong International Bridge is part of the 1,400 kilometer (km) regional East–West Economic Corridor (EWEC), which runs from the coastal town of Mawlamyine in Myanmar to the port of Da Nang in western Vietnam. The bridge links Mukdahan Province in northeastern Thailand, and Savannakhet province in central Lao PDR. Table 1 provides an overview of the economic conditions of economic hubs within EWEC, focusing on Mukdahan and Savannakhet.

Mukdahan is the second most important border cross-point between Lao PDR and Thailand: in 2005, Mukdahan accounted for 16.4% of total official border trade between the two countries (Paitoonpong, 2007). Cross-border trade notwithstanding, Mukdahan is one of Thailand's poorest provinces. Its population of 335 thousand is 0.51% of the national total but its gross provincial product (GPP) accounts for a little less than 0.13% of Thailand's national output. Its GPP per capita of USD800 is, accordingly, roughly one quarter of the national average. Mukdahan is less industrialized than other EWEC economic hubs in Thailand. The manufacturing sector accounts for only 10% of gross domestic product (GDP), compared with 39% for Thailand as a whole. Mukdahan's service sector accounts for the bulk of GPP at roughly 46%, compared with 38% for Thailand.

Savannakhet's population of 843 thousand accounts for 14.7% of Lao PDR's total population. Its GPP per capita is well below Mukdahan's, at USD525, although this is still roughly 85% of Lao PDR's national average. Savannakhet is the largest and most populous province in Lao PDR, with fertile land, forest, and mineral resources (Keorodom, et al., 2007; and Somphong, 2003). The province has the largest share of rice production in the country (JICA, 2007) and, not surprisingly, the agriculture sector accounts for half of Savannakhet's GPP. It also has the largest number of industry-handicraft establishments, mostly small establishments engaged in wood products, garments, and food processing (Keorodom, et al. 2007).

Table 2 provides the volume of trade between Mukdahan and Savannakhet, compared with other significant cross-border points in EWEC. Trade between the two provinces increased by more than 70% in 2007, following the completion of the Second Mekong International Bridge in December 2006. A reduction in export and import procedures at the Mukdahan border checkpoint has further facilitated cross-border trade. At present, import and export procedures at the Thailand and Lao PDR checkpoints require no more than 10 and 20 minutes, respectively. The Thai Customs Department's introduction of the paperless electronic customs system has also sped up customs procedures (Thai Government Public Relations Department, 2008). Future developments are expected to facilitate trade even further, including the implementation of the Greater Mekong Subregion Cross-Border Transport Agreement (CBTA) and the establishment of special economic zones (SEZs) in the two provinces.

The Cross-Border Transport Agreement (CBTA) and Special Economic Zones (SEZs). The CBTA is a comprehensive multilateral instrument covering several aspects of cross-border transport facilitation:

- single-stop/single-window customs inspection;
- cross-border movement of persons (e.g., visas for persons engaged in transport operations);
- transit traffic regimes, including exemptions from physical customs inspection, bond deposit, escort, and phytosanitary and veterinary inspection;
- eligibility requirements for road vehicle cross-border traffic;
- exchange of commercial traffic rights; and
- infrastructure, including road and bridge design standards, road signs and signals (ADB, 2009).

Full implementation of the CBTA was expected in 2008. The proposed Savan–Seno Special Economic Zone is Lao PDR's first SEZ and will consist of three industrial sites, one of which (Site A) comprises an area of 305 hectares (ha) adjacent to the Second Mekong international Bridge in Savannakhet. Site A's facilities will focus on the service sector and include residential areas; three- to five-star hotels; a duty free shop; an exhibition center; a golf course; and shopping, entertainment, and sports complexes (Bangkok Post, 2009; Centre for Logistics Research, Thammasat University and Supply Chain Engineering Management, Chiang Mai University, 2008; and JICA, 2007). Meanwhile, the Industrial Estate Authority of Thailand plans to establish a logistics center and small industrial estate for light industries in Mukdahan (Tsuneishi, 2007).

Impact of the Second Mekong International Bridge on Trade with Third Countries

The Mukdahan–Savannakhet border is an important gateway for trade not only between Lao PDR and Thailand, but also among the PRC, Thailand, and Viet Nam. Most of the trading companies that conduct import and export activities between Lao PDR and Viet Nam are located in the central district of Savannakhet province. Goods are unloaded at storehouses by Lao PDR trading companies and these are either sold within Lao PDR or re-exported. Re-exports make up the largest volume of trade in Savannakhet. Some goods and commodities are further processed in Lao PDR before being exported to Thailand (Development Analysis Network, 2005).

Initial estimates show that the Second Mekong International Bridge has led to significant reductions in trade transport costs between Thailand and Viet Nam, particularly between Hanoi and Bangkok. Table 3 summarizes available evidence on this point. The distance of travel between the two cities, previously about 2,000 km by way of the First Mekong International Bridge in Nong Khai, was shortened to 1,500 km. The land trip between Bangkok and Hanoi takes 3–4 days passing through the new Second Mekong International Bridge, which represents 70% less travel time than coastal shipping (about 2 weeks) (JICA, 2007 and Tsuneishi, 2007).

In 2005, an important policy change was introduced by the government of Lao PDR with implications for the bridge, which opened the following year. The export of unprocessed logs to all destinations was banned. Table 7 shows that in 2003 exports of forestry products, which include unprocessed logs, were zero to Mukdahan but significant to the rest of the world. Exports of processed timber, including furniture, were significant to both destinations as these exports were exempted from the ban. The treatment of partially processed timber, such as sawn logs, is an important issue. According to available evidence, the export of all processed timber was effectively exempted from the ban. Exporters have adjusted their production activities to ensure that processed timber products meet the requirements for export clearance at the border. The purpose of the export ban was partly to protect the forests of Lao PDR and partly to encourage the development of the domestic furniture industry.

3. The Under–Supply of Regional Public Goods

There are reasons to think that infrastructure projects of this kind, linking regions of adjacent countries, are especially important for developing countries. According to Birdsall (2004), regional public goods in developing countries remain underfunded despite their potentially high returns, compared with traditional single country-focused investments. The high returns arise from positive cross-border externalities or spillover effects, which are not necessarily taken into account in each individual country's investment decisions. Birdsall estimates that regional public goods receive only about 2.0%–3.5% of total official development assistance. A combination of practical and political economy factors account for this low percentage.

First, under-investment can occur because of coordination failure. That is, the overall performance of the project depends on a coordinated outcome between all participating countries. In such circumstances, the relationship between performance and outcome, or inputs and outputs, breaks down at the country level for regional projects. The uncertainty and risk of investing in a regional project are higher because the outcome—and hence the benefit—depends upon the performance of other partners. Furthermore, regional projects that produce largely regional (as opposed to national) public goods can also have significant asymmetries in costs and benefits across countries that result in further under-investment in such projects.

Second, according to Birdsall, bilateral aid agencies tend to prefer country-based transfers because they have the potential to provide greater geo-strategic and political benefits. Even within multilateral development agencies, the recent emphasis on country ownership of their own development priorities has often favored national programs over regional ones.

In this paper, we examine the extent to which such asymmetries may operate in the context of a specific cross-border regional project—the Second Mekong International Bridge linking Mukdahan Province in Thailand and Savannakhet Province in Lao PDR. Historically, each of these provinces has traded more extensively with the rest of the world than with each other. Despite being geographically close to one another, they are separated by the Mekong River, which is a very significant physical barrier. Prior to the

construction of the bridge, the river could be crossed by ferry for much of the year, but the process was costly.

In 2006, ADB and the Japan Bank for International Cooperation (JBIC), in cooperation with the governments of Thailand and Lao PDR, completed the construction of a bridge crossing the river and thus creating, for the first time, a direct road link between these two adjacent provinces. The width of the Mekong River at this point is around 2 km and the length of the two-lane bridge crossing it is about 4 km. Subsequently, the ADB and the governments of Thailand and Lao PDR implemented agreements on road construction on each side of the bridge and cooperation in the areas of customs, immigration, and quarantine to promote transport and trade facilitation. On each side of the bridge, the road linkage connects to the national road networks of Thailand and Lao PDR, respectively. All efforts are directed towards reducing the cost of trading between the provinces of the two neighboring countries, thereby improving human welfare in both countries.

These infrastructure investments, and others like them, can reasonably be expected to reduce transport costs and promote trade between the two provinces and with the rest of the world. But how will these economic changes affect economic welfare in the two countries, and to what extent will the impacts differ? This study applies a general equilibrium modeling framework to answering these questions.

4. The Unobserved Counterfactual and the Role of Economic Modeling

Benefit–cost analysis of an investment project inherently involves comparing outcomes that occur in the presence of a project with those that would have occurred in its absence. Therefore, at least one of the components of the comparison is always hypothetical. This essential point applies whether the analysis is conducted before (ex ante) or after (ex post) the investment is undertaken. In the case of ex ante assessment, both the outcomes of the project and the counterfactual—what would have happened without the project—involve hypothetical projections into the future. Both these forms of analysis are important, but ex ante assessment is more crucial in that it may influence decisions about whether the investment should occur. Ex post analysis is useful mainly in the lessons it may provide for the way ex ante analyses should be conducted.

In the case of ex post evaluations, the actual outcomes of the project may be known in the sense that data can exist on the historical inputs and outputs associated with the project. But these data can never reveal what would have happened if the project had not existed. The impact of the project necessarily involves the difference between what happens in the presence of the project—whether in the future or in the past—with something hypothetical. The former can potentially be observed empirically, when the project already exists, but the latter cannot be observed and can only be estimated. Data alone can never provide all the information needed for benefit-cost analysis. The essential problem arises for both project benefits and project costs, but is probably most acute in the case of project benefits.

Benefit–cost analysts use a variety of methods to deal with this problem. The construction of a counterfactual necessarily requires an economic model, even if the model is implicit. The present paper explores the use of general equilibrium modeling to estimate ex ante project benefits. It does this by simulating the full economic impact of the shocks that the existence of the project introduces into the local economy. Evaluating the project involves assessing these estimated impacts and comparing them with project costs. The focus of the paper is on determining the size of these impacts—the project benefits—rather than the implications of these results for the economic desirability of this particular project, which would involve study of the project's economic costs as well.

5. The Mukdahan–Savannakhet Input–Output Table

The input–output table constructed by Sim et al. (2007), referred to here as the Mukdahan-Savannakhet Input-output table (subsequently MSIO), describes transactions between Mukdahan and Savannakhet, and between these provinces and the rest of the world, constructed using data from the year 2003. It specifies 20 production sectors in each region. All values are specified in producer prices and are measured in US Dollars (USD). The transactions matrix has 60 rows and 40 columns. It describes the use of 20 types of intermediate goods from each of Mukdahan, Savannakhet, and the rest of the world as inputs into each of the 20 industries located in Mukdahan and Savannakhet provinces. The rest of the world category refers to all other provinces of Thailand and Lao PDR, as well as to all other countries.

Within the MSIO structure, there are no transport costs or other margins occurring between production and final users. In understanding this point, it is helpful to caricature the model as one in which the final users—including consumers, investors, and the government—reside permanently at the factory gates themselves, waiting for the goods to reach them. For the purposes of the present study, this structure was modified to create transport margins between firms and final users, where these margins are not necessarily the same for inter-regional exchanges (e.g., between Mukdahan and Savannakhet) as they are for intra-regional exchanges within each of these two regions.

One of the 20 industries is transport, which is used as an intermediate input into the production of each of the other industry outputs. Instead of treating transport as a pure intermediate good used directly in the production of output at producer prices, we allocate part of the output of this industry to the production of transport margins between production and final demand. We arbitrarily allocate 90% of all transport use to this margin category, leaving 10% for direct intermediate usage. The effect of this reallocation is that producer prices implicitly decline somewhat, but purchaser prices and GDP do not change.

Since the input–output structure identifies the use of inputs from each region in production in the other, this procedure leads to the estimation of transport margins per unit of sales, both for intra-regional sales within each of the two regions and inter-regional sales between them (in both directions). The results of this exercise are summarized in Table 4. Transport costs within Mukdahan itself are estimated to be 2.4% of final sales, but transport costs from Mukdahan to Savannakhet are 6.5% of sales.

Inter-regional trade from Mukdahan to Savannakhet incurs a transport cost premium of 164% relative to intra-regional trade within Mukdahan itself. Similarly, inter-regional trade from Savannakhet to Mukdahan incurs transport costs of 4.3% of sales, compared to trade within Savannakhet itself of only 0.08%. This implies a transport cost premium for inter-regional trade from Savannakhet to Mukdahan of 97%.

Final demand in the two provinces is summarized in Table 5. GDP is the sum of rows 1–9, which explains the negative signs before imports from the rest of the world. Although Savannakhet is considerably poorer than Mukdahan in per capita terms, its much larger population means that Savannakhet's economy is somewhat larger, with regional GDP of USD339 million compared to Mukdahan's USD232 million. The initial value of sales from Mukdahan to Savannakhet is about triple the value of sales in the opposite direction.

The meaning of "net margin" in Table 5 requires explanation. It should be recalled that the input–output table is compiled in producers' prices rather than purchasers' prices. Transport margins are assumed to be supplied in the source region rather than the destination region. Net margin is the difference between the value of the margins supplied in the source region in delivering sales to the other region, and the value of the margins purchased from the other region in the form of the goods purchased from it. Margins supplied to inter-regional trade are essentially exports of services that need to be counted in GDP, but should not be counted when the goods are valued solely at producer prices, since these prices exclude margins. This is an accounting issue that does not arise for trade with the rest of the world, because free-on-board (FOB) prices for exports and cost, insurance, and freight (CIF) prices for imports already allow for these margins. Since inter-regional sales from one region are equivalent to inter-regional purchases from the other, the net margin balance of one region must be equal and opposite in sign (i.e. positive or negative) to the net margin balance of the other.

Table 6 summarizes sales within the Mukdahan–Savannakhet regional economy, distinguishing between intra-regional sales and inter-regional sales. For Mukdahan, sales to Savannakhet were valued at USD6.4 million, representing just 1.6% of total sales within the region (not including exports to the rest of the world). For Savannakhet, sales to Mukdahan were valued at USD2 million, representing only 0.3% of total regional sales. The data suggest that the base level of inter-regional trade between these two provinces is very small. Exports to the rest of the world were more important for Mukdahan, by a factor of about 14, and more important for Savannakhet, by a factor of more than 30. The commodity composition of these inter-regional sales is summarized in Table 7. For Mukdahan, sales to Savannakhet were dominated by food and textiles; for Savannakhet, sales to Mukdahan were dominated by wood and paper products.

6. The Mukdahan–Savannakhet Regional General Equilibrium Model

This section describes a general equilibrium model of the Mukdahan and Savannakhet regional economy, constructed specifically for the purpose of this study and based on the modified version of the MSIO input–output table summarized above. For brevity, the

resulting general equilibrium model will subsequently be called M-SGEM. Its relationship to the more familiar single-country general equilibrium models, which exist for many countries, is that we imagine Mukdahan and Savannakhet to be two regions of a single economy trading with the outside world. The outside world includes all other provinces of Thailand and Lao PDR, and all other countries. M-SGEM includes the specification of two-way transport costs between the two regions, Mukdahan and Savannakhet. The shock to this economy that will form the core of the analysis is a reduction in these two-way, inter-regional transport costs, corresponding to the estimated transport cost reductions arising from the construction of the bridge and its associated road connections.

Unless otherwise stated, the database of the model refers to the year 2003, the year described in the MSIO input–output table summarized above. The bridge did not open until 2006, so the analysis assumes that the structure of the Mukdahan–Savannakhet regional economy was roughly the same in 2006 as it was in 2003. The model's main features are as follows.

6.1 Model Structure

The theoretical structure of M-SGEM is relatively conventional. It belongs to the class of general equilibrium models that are linear in proportional changes, sometimes referred to as Johansen models. The highly influential ORANI general equilibrium model of the Australian economy (Dixon, et al. 1982) uses this approach, as does the Global Trade Analysis Project (GTAP) model of the global economy (Hertel 1999). The detailed structure of M-SGEM is based on the TERM general equilibrium model of the Australian economy (Horridge et al. 2006). However, this general structure is adapted to reflect the specific objectives of the present study and important features of the Thai and Lao PDR economies.

The microeconomic behavior assumed within M-SGEM is competitive profit maximization on the part of all firms, and competitive utility maximization on the part of consumers. Each industry in each region has constant returns-to-scale technology and there is at least one industry-specific factor present in each industry. In the simulations, the markets for final outputs, intermediate goods, and factors of production are all assumed to clear at prices that are determined endogenously within the model.

The currency used within the data base of M-SGEM is the US Dollar. Its (imaginary) exchange rate relative to the rest of the world is fixed exogenously and its role within the model is to determine, along with international prices, the nominal domestic price level. The model is homogeneous (degree one for prices and degree zero for quantities) with respect to this exchange rate. Therefore, if domestic prices were to adjust flexibly to clear markets, then a 1.0% increase in the exchange rate would result in a 1.0% increase in all nominal domestic prices, leaving all real variables unchanged.

6.2 Industries

The model contains 20 industries in each of the two regions, based on MSIO. They include three agricultural industries: crops; livestock and poultry; and forestry and

logging. Non-agricultural industries include: mining and quarrying; seven manufacturing industries; and nine services and utilities industries, one of which is transport. The transport industry is especially important for the present study. Each industry produces a single output, and the set of commodities coincides with the set of industries.

6.3 Commodities

An Armington structure is used to relate domestic production, consumption, international trade, and inter-regional trade. The price definitions used within this structure are summarized in Table 8. For each commodity, the commodity name appears as a superscript. There are also two subscripts denoting the source and destination of the commodity, respectively. Thus, P^i_{MS} denotes the price of good i produced in source M (Mukdahan) and sold in destination S (Savannakhet). Goods originating from the rest of the world (imports) are denoted with * for source. Thus, the price of imports of good i sold in Mukdahan is denoted P^i_{*M}. In the case of exports, the destination is denoted *, so the price of good i that originates in Savannakhet and is sold in foreign markets (exports) is denoted P^i_{S*}.

The structure of commodity substitution is summarized in Figure 1. Armington substitution occurs at two levels. We will take the case of goods sold in Mukdahan (destination M) as an illustration. First, a good produced in Mukdahan and sold in Mukdahan (price P^i_{MM}) substitutes imperfectly with a similar good produced in Savannakhet and sold in Mukdahan (price P^i_{SM}) to produce the domestic version of the good (price P^i_{DM}). This substitution process is denoted as Level I in Figure 1. This domestic version of the good is an imperfect substitute for final users, with the imported version of the good (price P^i_{*M}) denoted Level II. The price to final users (such as consumers) of the resulting composite commodity is denoted P^i_{CM}.

Although the sets of producer goods and consumer goods have the same names, the commodities themselves are not identical. Each of the 20 consumed goods consists of a composite of the domestically produced and imported version of the same commodity, where the two are imperfect substitutes. The domestically produced version is an Armington composite of goods produced in the two regions. The proportion in which they are combined reflects consumer choices and depends on both (i) the relative prices of these imported and domestically produced versions of the good, and (ii) the Armington elasticity of substitution between them.

6.4 Factors of Production

The mobility of factors of production is a critical feature of any general equilibrium system, where the term mobility means the capacity to move across economic activities (industries) and not necessarily the capacity to move geographically. The greater the inter-sectoral factor mobility that is built into the model the more flexible the economy, as reflected in its simulated capacity to respond to changes in the economic environment. It is essential that assumptions about the mobility of factors of production be consistent with the length of run that the model is intended to capture.

There are two treatments for the mobility of labor, capital and agricultural land, reflecting two different periods of adjustment:

Short-Run—within each province, labor is mobile across all industries, but capital and agricultural land are each immobile across industries.

The short-run assumptions represent a length of time for adjustment that is sufficient for the movement of labor among industries in response to changes in rates of return to labor, but insufficient for the reallocation of capital through investment and disinvestment in capital stocks, or for the reallocation of land via crop substitution. These strong assumptions on capital immobility mean that the short-run represents an adjustment period of 2–3 years.

Long-Run—labor is mobile between Mukdahan province and the rest of Thailand, and the real wage within Mukdahan is determined exogenously by the real wage within Thailand. Similarly, labour is mobile between Savannakhet and the rest of Lao PDR at an exogenous real wage. Labor is not mobile between Mukdahan and Savannakhet. Capital is mobile both across industries and internationally. The rate of return is exogenously fixed and is determined by the international rate of return. Agricultural land is mobile across agricultural industries, but fixed in total supply.

In the long-run, labor moves from the rest of Thailand into Mukdahan, or vice versa, in response to changes in the real wage within Mukdahan. The same mobility occurs between Savannakhet and the rest of Lao PDR. Capital stocks adjust through international movement of capital sufficient to equalize rates of return to capital across industries. In addition, agricultural land moves across agricultural industries, meaning that the commodities produced on particular pieces of land adjust in response to changes in the rate of return to land. However, the total supply of agricultural land remains the same. These long-run assumptions are designed to represent a duration for adjustment of approximately 10 years.

6.5 Technology

In every sector there is a constant elasticity of substitution production technology with diminishing returns to scale to variable factors alone. However, there is also a sector-specific fixed factor (immobile capital or land) in every sector. Constant returns to scale applies with respect to all factors together. This assumption implies that: (i) each factor demand function is homogeneous of degree one in output; and (ii) in each sector, there is a zero profit condition, which equates the price of output to the minimum unit cost of production. This condition can be thought of as determining the price of the specific factor in that sector.

6.6 Households

The model includes one household in each region—a Mukdahan and a Savannakhet household. Future development of the model may include multiple households within each region, giving the model the capability to generate income distributional results within regions. The final commodity demand system assumed within the model is Cobb–

Douglas, for simplicity and convenience.

6.7 Elasticity Estimates

The elasticity estimates used in M-SGEM are standard default elasticities used within general equilibrium models of this type. The CES elasticities of factor substitution in production are set at 0.5 in all cases. Referring to Figure 1, Armington elasticities of substitution at Level I are set at 2, and at level II they are set at 5. All export demand elasticities were set at 20. The elasticities of supply of imports to the Mukdahan–Savannakhet economy are assumed to be infinite and import prices were, therefore, set exogenously.

6.8 Treatment of Transport Costs

The information on transport costs described above was used to allocate the output of the transport industry in the input–output table to transport margins between final and producer prices in each of the four household categories. The important case is inter-regional transport margins, where the price relationships are:

$$P^i_{MS} = P^i_{MM}(1+V^i_{MS}) \quad (1)$$

$$P^i_{SM} = P^i_{SS}(1+V^i_{SM}) \quad (2)$$

where P^i_{MS} is the price of good i in destination *M* (Mukdahan) from source *S* (Savannakhet), and so forth, while V^i_{MS} and V^i_{SM} are the inter-regional proportional rates of transport cost from Mukdahan to Savannakhet and vice versa, respectively.

7. Simulations and Results

7.1 The Shocks

Table 4 above confirms that transport costs per unit of final sales are higher for inter-regional trade than for intra-regional trade. This describes the situation before the existence of the bridge and its connecting roads. The bridge links the two provinces more efficiently and reduces inter-regional transport costs. In the simulations reported here, the bridge is represented as a reduction in this differential between inter-regional and intra-regional transport costs to zero. That is, transport costs between regions are reduced to the same level as transport costs within regions. Transport costs for intra-regional trade remain unchanged because it is assumed that only inter-regional transport costs are affected by the bridge. The modeling mechanism by which transport costs are reduced is through neutral technical change in all inputs. These assumptions are intended to be indicative of what might reasonably be expected based on other studies of the effects of major infrastructure developments of this kind.

Table 9 summarizes these shocks. Inter-regional transport costs from Mukdahan to Savannakhet are reduced from 6.52% of final sales to 2.36%, representing an absolute reduction of 4.16% as a percentage of total sales. Transport costs in the reverse direction are reduced by an almost identical absolute amount of 4.19% of total sales.

7.2 Model Closure

The simulations differ according to the length of run over which the analysis is conducted, by varying the assumed mobility of factors of production, as described above. Simulations 1 and 2 refer to the short-run and long-run mobility assumptions, respectively.

Since real household consumption expenditure is chosen as the basis for welfare measurement, the macroeconomic closure must be made compatible with both this measure and with the single-period horizon of the model. This is done by ensuring that the full economic effects of the shocks are channeled into current-period household consumption and do not leak in other directions, with real-world inter-temporal welfare implications not captured by the welfare measure. The choice of macroeconomic closure may thus be seen in part as a mechanism for minimizing inconsistencies between the use of a single-period model to analyze welfare results, and the multi-period reality that the model depicts.

To prevent inter-temporal and other welfare leakages from occurring, the simulations are conducted with balanced trade (exogenous balance on current account) in each region. Balanced trade means that for each of the two regions, the change in the value of net exports (gross exports minus gross imports) to the rest of the world plus the change in the value of net exports (sales minus purchases) to the other region must sum to zero. This ensures that the potential benefits from the shock do not flow to foreigners through a current account surplus, or that increases in domestic consumption are not achieved at the expense of borrowing from abroad in the case of a current account deficit. For the same reason, real government spending on each good is fixed exogenously. The government budget deficit is held fixed in nominal terms. This is achieved by endogenous across-the-board adjustments to the sales tax rate, so as to restore the base level of the budgetary deficit. The combined effect of these features of the closure is that the full effects of changes in policy are channeled into household consumption and not into effects not captured within the single-period focus of the model.

Finally, in recognition of the Lao PDR government's export ban on logs, changes in exports of forestry are constrained to zero. This is achieved within the model by treating the level of these exports to Mukdahan and the rest of the world as exogenously fixed and by setting an export tax on forestry products, which adjusts endogenously to sufficiently choke off any such changes from occurring.

7.3 Results: Short-Run

Table 10 summarizes the short-run macroeconomic effects of reduction in transport costs. In this table, as in each subsequent table of results, both the percentage change and the absolute change in each variable are shown. The absolute change is equal to

the percentage change multiplied by the initial level of the variable, divided by 100 and expressed in thousands of US dollars.

In general, the estimated short-run impacts are quite small. Both the proportional and the absolute increase in real GDP is larger in Savannakhet than in Mukdahan. A similar result applies to the change in real consumption. It is not the case that the richer region (Mukdahan) enjoys all, or even most, of the benefits from the improved infrastructure. The absolute increase in Savannakhet exceeds that in Mukdahan by an even larger margin because the initial level of GDP (and real consumption) was higher. Table 11 shows the absolute change in nominal GDP and its components. The absolute price level rises in Mukdahan and falls slightly in Savannakhet. Both regional and non-regional exports increase in Savannakhet, but the increase in regional exports from Mukdahan is partly at the expense of a decline in exports to the rest of the world. Similarly, the increase in regional imports in both regions is partly at the expense of a decline in imports from the rest of the world.

Table 12 shows the composition of the changes in inter-regional trade. Increased exports from Mukdahan are moderate in total (USD0.6 million) and are concentrated in food and textiles. The increased exports from Savannakhet are only half as large in total and mostly take the form of processed timber products and crops. Table 13 shows that exports to the rest of the world decline in each of these four above-mentioned categories. The reduced inter-regional transport costs have caused some increase in total exports and also a significant re-allocation of exports from the rest of the world to the regional trading partner, to whom transport costs have fallen.

Output expands in each of the two regions in the food and textiles sectors, but declines in the transport sectors of both regions, reflecting the greater productivity of the transport system as a result of the bridge.

7.4 Results: Long-Run

The long-run results differ from the above because of greater mobility of factors of production, hence the greater scope for economic adjustment to the reduction in inter-regional transport costs. The difference between these two sets of results is an indication of the contribution that greater factor mobility makes to the overall impact of reduced transport costs. The results indicate that this contribution is very large. The absolute gain in welfare (aggregate real consumption) that arises in the long-run is larger than the short-run impact by a factor of 23 in Mukdahan and 28 in Savannakhet, while both the absolute and proportional gains in welfare are still considerably larger in Savannakhet. Regional exports increase in both, but especially in Mukdahan. As before, the increase in regional trade (both exports and imports) is partly at the expense of a decline in trade with the rest of the world (Tables 17 and 18).

The industrial composition of the increase in inter-regional exports (Table 17) is similar to the short-run case (food and textiles from Mukdahan, and wood/paper and crops from Savannakhet), but the absolute magnitudes are larger. Within both regions, the composition of output moves towards food and textiles and in Savannakhet it moves towards the wood/paper sector and away from mining (Table 19).

8. Conclusions

This study uses a general equilibrium framework to study the regional economic effects of infrastructure improvements designed to reduce the costs of inter-regional trade. The results suggest that in the short-run the kind of transport cost reductions that are consistent with improvement of inter-regional transport facilities will produce a modest increase in inter-regional trade volumes in both directions. This coincides with a small increase in real consumption in both regions. Over a longer period of time, the benefits to both regions are very much larger, as investors respond to the changed structure of incentives with new capital investments and as workers move to regions of greater return to their labor. The results do not confirm the common presumption that the benefits from cross-border infrastructure projects occur only, or overwhelmingly, in the richer region.

The analysis presented in this study does not cover all possible benefits from the construction of the bridge. It concentrates on the impact in the two provinces adjacent to the bridge itself. Broader economic benefits to Thailand and Lao PDR, as well as benefits to neighboring countries, are important but are not quantified by this study. The development of entirely new industries is a further possible real world development that is not captured. Moreover, the analysis focuses on reduced transport costs in the movement of goods. But reduced costs in the movement of people, especially in the form of time saved in crossing the river, may be important as well. For example, the bridge seems to have facilitated two-way tourist movement between Thailand and Vietnam, crossing through Lao PDR, which is not captured by the analysis.

The objective of this study was in part methodological. The results suggest that general equilibrium modeling is a promising methodology for estimating the possible benefits from infrastructure investments. The basic methodology of general equilibrium modeling is well established, although new developments are continuously being created. However, the application of this field of analysis to the estimation of the impact of large investment projects is in its infancy. The present study is only a first step, and more work is required to achieve the most operationally useful modeling approaches for practical application.

This work might also be usefully extended to poverty analysis. A multi-household version of the model would make it possible to assess the distributional impact of the project within each region, including estimating the effects on poverty incidence and inequality, which are vital policy considerations in both Mukdahan and Savannakhet.

Table 1: General Economic Structure within EWEC

Economic Hub	Area (km^2)	GPP (USD Million)	Population (Million)	GPP per Capita	Sector Shares of GPP (%)			
					Agriculture	Manufacturing	Other Industry	Services
Thailand	513,115	213,294	65.87	3,238	8.90	39.30	13.70	38.10
Mukdahan	4,339	268	.335447	800	18.32	10.28	25.42	45.98
Lao PDR	236,800	3,542	5.74	617	42.30	31.70	2.00	25.00
Savannakhet	21,774	443	.843245	525	50.00	25.00	0.00	25.00

EWEC = East–West Economic Corridor, GPP = gross provincial product, km^2 = kilometers squared.
Note: Includes Lao People's Democratic Republic (Lao PDR) government estimates.

Source: Centre for Logistics Research, Thammasat University and Supply Chain Engineering Management, Chiang Mai University.

Table 2: Trade in Mukdahan– Savannakhet vs. Selected EWEC Cities (USD Million)

Year	Tak		Mukdahan–Savannakhet		Dansavanh–Laobao	
	Thailand Imports from Myanmar	Myanmar Imports from Thailand	Lao PDR Imports from Thailand	Thailand Imports from Lao PDR	Lao PDR Imports from Vietnam	Vietnam Imports from Lao PDR
2000	16.85	97.54	138.27	36.31	n.a.	n.a.
2001	41.37	78.38	110.03	21.66	n.a	n.a.
2002	20.72	88.33	99.74	22.04	13.71	11.9
2003	11.81	125.75	100.60	19.97	1.9	22.27
2004	15.77	288.36	146.00	16.81	3.11	32.47
2005	20.55	329.48	145.16	25.80	5.59	49.18
2006	33.92	315.18	168.56	78.82	13.97	107.31
2007	26.80	299.00	259.59	166.08	12.65	117.71

EWEC = East–West Economic Corridor, Lao PDR = Lao People's Democratic Republic, n.a. = not applicable.

Source: Centre for Logistics Research, Thammasat University and Supply Chain Engineering Management, Chiang Mai University.

Table 3: Inter-City Container Cargo Transport in the Greater Mekong Subregion

Route	Land Transport			Sea Transport		Remarks
	Km	Day	Cost (USD)	Day	Cost (USD)	
Guangzhou–Hanoi	1,190	2	3,000	4–6	1,500	40 ft container including customs
HCMC–Hanoi	1,600	3–4	1,200	4–6	750	40 ft container domestic cargo
Bangkok–Hanoi	1,555	3–4	4,200	10–15	2,000	40 ft container including customs
Bangkok–HCMC	913	2	1,390	2–3	560	10t truck and 20ft container, excluding customs
Bangkok–Yangon	945	3	730	30	1,130	10t truck and 20 ft container, excluding customs

HCMC = Ho Chi Minh City; ft = foot, km = kilometer, t = ton.

Source: JICA, 2007.

Table 4: Transport Margins (Percentage of Sales)

		To:	
		Mukdahan	Savannakhet
From:	Mukdahan	2.36	6.52
	Savannakhet	4.27	0.08

Source: Authors' calculations based on Sim et al. (2007).

Table 5: Final Demand in Mukdahan and Savannakhet Provinces in 2003 (USD '000)

	Mukdahan	Savannakhet
Household consumption	173,258	290,354
Investment	57,861	109,119
Government	36,487	8,957
Stocks	4,572	11,817
Exports to ROW	90,808	76,927
Imports from ROW	–135,518	–153,689
Regional exports	6,392	2,002
Regional imports	–2,002	–6,392
Net margin	357	–357
Total GDP	232,215	338,738

GDP = gross domestic product.
Note: ROW (rest of the world) does not include the partner region (Mukdahan or Savannakhet).
The category of net margin is explained in the text.

Source: Authors' calculations based on Sim et al. (2007).

Table 6: Total Sales within the Mukdahan–Savannakhet Regional Economy in 2003

	Mukdahan	Savannakhet	Total
Mukdahan	393,203	6,392	399,595
Savannakhet	2,002	585,411	587,413
Total	395,205	591,803	987,008

Source: Authors' calculations based on Sim et al. (2007).

Table 7: Initial Levels of Inter-Regional Trade in 2003 (USD '000)

	Exports from Mukdahan to Savannakhet	Exports from Mukdahan to the Rest of the World	Exports from Savannakhet to Mukdahan	Exports from Savannakhet to the Rest of the World
Crops	0.7	23,580	342	4,150
Livestock	13.8	2	20	11,096
Forestry	4.5	34	0	1,120
Mining	0.0	2,300	0.9	30,746
Food	3,192	13,483	3	16,440
Textiles	1,464	6,652	23	977
Wood/paper	17	98	1,604	1,795
Chemicals	100	0	0	0
Minerals	999	82	0	0
Machinery	553	0	0	0
Construction	0	126	0	0
Transport	50	6,439	10	319
Telecom	0	141	0	479
Trade	0	6,040	0	5,889
Personal services	0	32,079	0	35,940
Total	6,392	91,055	2,002	167,925

Note: Categories in which all entries are zero have been deleted for brevity. For the full list of all 20 industries, see Table 14.

Source: Authors' calculations based on Sim et al. (2007).

Table 8: Price Definitions

		Destination		
		Mukdahan	**Savannakhet**	**Export**
Source	Mukdahan	P^i_{MM}	P^i_{MS}	P^i_{MM}
	Savannakhet	P^i_{SM}	P^i_{SS}	P^i_{S*}
	Import	P^i_{*M}	P^i_{*S}	n.a.
	Domestic	P^i_{DM}	P^i_{DS}	n.a.
	Consumer	P^i_{CM}	P^i_{CS}	n.a.

n.a. = not applicable.

Table 9: Shocks to Inter-Regional Transport Margins

	Reductions in Transport Costs (% of Total Sales)	
To:	Mukdahan	Savannakhet
From:		
Mukdahan	0	–4.16
Savannakhet	–4.19	0

Source: Authors' calculations.

Table 10: Summary of Macroeconomic Results in the Short-Run

	Percentage Change		Absolute Change (USD '000)	
	Mukdahan	Savannakhet	Mukdahan	Savannakhet
Real GDP	0.040	0.087	93.49	294.48
Real household consumption	0.073	0.091	126.58	263.28
Real exports to ROW	–0.263	0.044	–238.85	33.82
Real imports from ROW	–0.101	–0.038	–136.30	–58.48
Sales to other region	8.820	16.020	565.47	321.32
Purchase from other region	16.020	8.820	321.32	565.47

GDP = gross domestic product.
Note: ROW (rest of the world) does not include the partner region (Mukdahan or Savannakhet) and is fixed exogenously at zero.

Source: Authors' calculations.

Table 11: Change in Composition of Nominal GDP in the Short-Run

	Percentage Change		Absolute Change (USD '000)	
	Mukdahan	Savannakhet	Mukdahan	Savannakhet
GDP	0.072	0.072	167.36	244.25
Household consumption	0.100	0.074	173.20	213.96
Investment	–0.022	0.024	–12.87	26.67
Government spending	–0.019	0.043	–6.85	3.81
Stocks	0.304	–0.002	13.89	–0.20
Non-regional exports	–0.250	0.042	–226.91	32.13
Non-regional imports (-)	0.101	0.038	136.30	58.48
Regional exports	9.461	16.494	604.76	330.17
Regional imports (-)	–16.494	–9.461	–330.17	–604.76
Net margin	–51.598	–51.598	–183.99	183.99

GDP = gross domestic product.
Note: Imports enter the table with a negative sign because of the national accounting identity that GDP is equal to consumption plus investment plus government spending plus exports, and minus imports. Consequently, the table says that non-regional imports decline in both regions and regional imports rise.

Source: Authors' calculations.

Table 12: Composition of Changes in Inter-Regional Trade in the Short-Run

	Percentage Change		Absolute Change (USD '000)	
	Mukdahan	**Savannakhet**	**Mukdahan**	**Savannakhet**
Crops	8.826	8.895	0.06	30.44
Livestock	8.779	8.991	1.21	1.75
Forestry	8.970	0.000	0.40	0.00
Mining	0.000	8.943	0.00	0.08
Food	8.744	8.731	279.10	0.25
Textiles	10.353	6.216	151.61	1.40
Wood/paper	–1.539	17.674	–0.26	283.45
Chemicals	11.754	0.000	11.71	0.00
Minerals	4.278	0.000	42.73	0.00
Machinery	7.879	0.000	43.54	0.00
Transport	69.737	33.155	34.55	3.29

Note: Categories in which all entries are equal to zero have been deleted for brevity. For the full list of all 20 industries, see Table 14.

Source: Authors' calculations.

Table 13: Change in Exports to the Rest of the World in the Short-Run

	Percentage Change		Absolute Change (USD '000)	
	Mukdahan	Savannakhet	Mukdahan	Savannakhet
Crops	0.001	–0.847	0.37	–37.92
Livestock	–0.611	–0.183	–0.01	–21.97
Forestry	–1.498	0.000	–0.58	0.00
Mining	–0.028	–0.013	–0.74	–4.47
Food	–1.632	0.738	–250.45	130.93
Textiles	–1.962	9.779	–148.48	102.85
Wood/paper	84.686	–9.032	87.04	–174.97
Chemicals	–6.924	25.948	0.00	0.00
Minerals	–38.086	12.026	–35.36	0.00
Machinery	–10.395	2.882	0.00	0.00
Other manufacturing	0.000	–0.262	0.00	0.00
Electricity & water	–0.270	–0.143	0.00	0.00
Construction	0.556	–0.554	0.80	0.00
Transport	18.919	167.785	138.51	57.51
Telecom	–0.875	–0.026	–1.41	–0.13
Trade	1.356	0.432	9.32	2.75
Banking	0.249	–1.120	0.00	0.00
Real estate	–1.801	–1.412	0.00	0.00
Public sector	0.376	–0.847	0.00	0.00
Personal services	–0.097	–0.443	–35.25	–18.45

Source: Authors' calculations.

Table 14: Changes in Industry Outputs in the Short-Run

	Percentage Change		Absolute Change (USD '000)	
	Mukdahan	Savannakhet	Mukdahan	Savannakhet
Crops	0.009	0.003	5.73	1.58
Livestock	0.008	–0.005	1.19	–6.48
Forestry	0.029	0.035	0.10	2.40
Mining	0.002	–0.013	0.10	–4.02
Food	0.097	0.015	94.04	28.61
Textiles	0.091	0.356	10.58	17.26
Wood/paper	1.063	0.176	1.72	19.05
Chemicals	0.367	0.627	2.24	0.59
Minerals	0.915	0.275	6.22	1.70
Machinery	2.210	0.079	24.99	5.67
Other manufacturing	0.000	–0.001	0.00	–0.06
Electricity & water	0.017	–0.014	1.14	–0.66
Construction	0.002	0.000	0.83	–0.14
Transport	–0.819	–6.513	–96.26	–43.70
Telecom	0.017	–0.017	1.52	–0.11
Trade	–0.024	–0.023	–11.63	–11.80
Banking	0.045	0.001	6.22	0.04
Real estate	0.008	0.003	1.07	0.28
Public sector	0.000	0.011	0.00	1.33
Personal services	0.005	0.000	4.67	–0.20

Source: Authors' calculations.

Table 15: Summary of Macroeconomic Results in the Long-Run

	Percentage Change		Absolute Change (USD '000)	
	Mukdahan	Savannakhet	Mukdahan	Savannakhet
Real GDP	1.305	2.337	3029.33	7906.05
Real household consumption	1.643	2.547	2846.08	7389.16
Real export to ROW	1.283	3.129	1164.28	2405.25
Real import from ROW	0.988	1.335	1338.59	2051.81
Sales to other region	13.179	21.694	842.27	433.95
Purchase from other region	21.694	13.179	433.95	842.27

Note: ROW (rest of the world) does not include the partner region (Mukdahan or Savannakhet) and is fixed exogenously at zero.

Source: Authors' calculations.

Table 16: Change in Composition of Nominal GDP in the Long-Run

	Percentage Change		Absolute Change (USD '000)	
	Mukdahan	Savannakhet	Mukdahan	Savannakhet
GDP	1.219	2.086	2831.05	7067.54
Household consumption	1.591	2.363	2756.98	6862.11
Investment	-0.039	-0.146	-22.43	-158.94
Government spending	-0.067	-0.146	-24.38	-13.11
Stocks	2.644	3.189	120.86	376.83
Non-regional exports	1.218	2.970	1106.06	2284.99
Non-regional imports (–)	-0.988	-1.335	-1338.59	-2051.81
Regional exports	13.126	21.529	839.05	430.96
Regional imports (–)	-21.529	-13.126	-430.96	-839.05
Net margin	-49.234	-49.234	-175.56	175.56

GDP = gross domestic product.
Note: Imports enter the table with a negative sign because of the national accounting identity that GDP is equal to consumption plus investment plus government spending plus exports minus imports. Thus, the table indicates that non-regional imports decline in both regions and regional imports rise.

Source: Authors' calculations.

Table 17: Composition of Changes in Inter-Regional Trade in the Long-Run

	Percentage Change		Absolute Change (USD '000)	
	Mukdahan	**Savannakhet**	**Mukdahan**	**Savannakhet**
Crops	11.539	10.790	0.08	36.92
Livestock	11.515	11.245	1.59	2.19
Forestry	11.486	0.000	0.52	0.00
Mining	0.000	10.176	0.00	0.09
Food	11.553	10.920	368.74	0.32
Textiles	16.491	11.112	241.48	2.51
Wood/paper	11.423	24.393	1.93	391.19
Chemicals	18.546	0.000	18.47	0.00
Minerals	13.405	0.000	133.87	0.00
Machinery	11.064	0.000	61.14	0.00
Transport	29.621	10.443	14.67	1.04

Note: Categories for which all entries are zero have been deleted for brevity. For the full list of all 20 industries, see Table 14.

Source: Authors' calculations.

Table 18: Exports to the Rest of the World in the Long-Run

	Percentage Change		Absolute Change (USD '000)	
	Mukdahan	Savannakhet	Mukdahan	Savannakhet
Crops	1.267	2.794	339.87	125.15
Livestock	0.924	3.220	0.02	385.60
Forestry	0.932	0.000	0.36	0.00
Mining	0.913	1.810	23.89	600.46
Food	1.107	4.606	169.80	817.11
Textiles	0.985	27.572	74.52	289.99
Wood/paper	124.355	2.850	127.81	55.22
Chemicals	0.678	52.743	0.00	0.00
Minerals	0.924	53.852	0.86	0.00
Machinery	0.404	8.092	0.00	0.00
Other manufacturing	0.000	2.253	0.00	0.00
Electricity & water	0.721	2.682	0.00	0.00
Construction	0.853	3.287	1.23	0.00
Transport	1.330	50.180	9.74	17.20
Telecom	1.000	2.841	1.61	14.67
Trade	1.028	2.597	7.06	16.51
Banking	2.747	2.871	0.00	0.00
Real estate	0.987	2.973	0.00	0.00
Public sector	1.346	2.973	0.00	0.00
Personal services	1.125	2.081	410.69	86.72

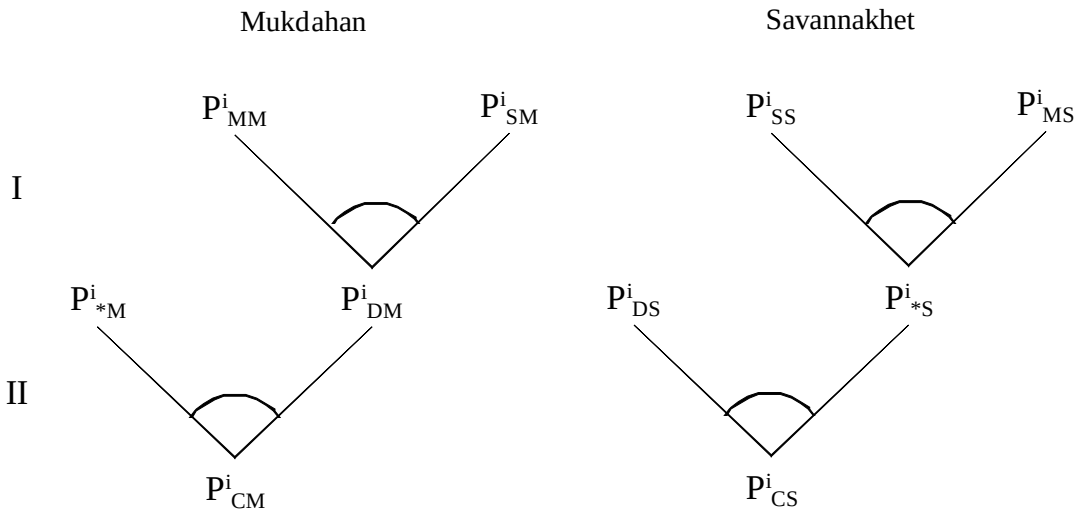
Source: Authors' calculations.

Table 19: Changes in Industry Outputs in the Long-Run

	Percentage Change		Absolute Change (USD '000)	
	Mukdahan	Savannakhet	Mukdahan	Savannakhet
Crops	1.484	2.727	932.69	1,306.00
Livestock	1.866	2.677	287.30	3,169.55
Forestry	1.545	2.620	5.44	178.27
Mining	1.027	1.800	42.96	563.74
Food	1.953	2.671	1,898.27	5,196.32
Textiles	3.291	7.567	384.19	366.67
Wood/paper	14.476	4.950	23.42	535.27
Chemicals	4.193	8.984	25.64	8.39
Minerals	12.301	4.391	83.60	27.13
Machinery	5.654	2.183	63.93	156.73
Other manufacturing	0.000	2.398	0.00	103.88
Electricity & water	1.663	2.696	113.50	127.73
Construction	0.020	0.071	7.64	57.43
Transport	-0.884	-9.346	-103.86	-62.71
Telecom	1.491	2.822	133.33	18.10
Trade	1.216	2.187	577.10	1,116.52
Banking	1.579	2.133	217.60	129.85
Real estate	1.627	2.471	225.93	239.98
Public sector	0.000	0.856	0.00	107.54
Personal services	1.247	2.286	1,120.87	1,199.36

Source: Authors' calculations.

Figure 1: Armington Price Substitution Relationships



Note: I denotes the first level of the Armington substitution process, in which goods from the two regions substitute for one another to produce a "domestic" good within each region. Similarly, II denotes the second level, in which the domestic good and imports substitute for one another to produce a 'composite' good. P^i_{jk} denotes the price of good i from source j in destination k, where S denotes Savannakhet, M denotes Mukdahan, D denotes domestic, * denotes imports, and C denotes composite. Thus, for example, P^5_{SM} denotes the price of good 5, derived from Savannakhet (source S) and sold in the Mukdahan market (destination M).

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The evidence on the economic benefits of cross-border projects, and how they are distributed across countries and over time, is limited. In this paper, Peter Warr, Jayant Menon and Arief Anshory Yusuf build a general equilibrium model to analyze the economic impacts of the Second Mekong International Bridge linking Mukdahan Province in Thailand with Savannakhet Province in the Lao PDR. They find that the reductions in transport costs increase trade volumes and incomes in both regions, and that these benefits increase significantly over time. There is no evidence to support the common presumption that the benefits from cross-border infrastructure projects occur only, or overwhelmingly, in the richer region.

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Publication Stock No.

Printed in the Philippines